REMARKS/ARGUMENTS

Reconsideration of the above-identified application respectfully requested.

The Claim Rejections

Claims 34-41, 43, and 45-62 stand rejected under the provisions of 35 U.S.C. § 112, second paragraph, as being indefinite in calling for the transport polyurethane polymer to be "enriched.

Claims 34-41, 43, and 45-62 also stand rejected under the provisions of 35 U.S.C. § 103(a) as being unpatentable over Dodge (U.S. Patent No. 5,708,073) in view of Balm Paints (GB 1,288,5830) in view of Van Voris (U.S. Patent No. 5,801,194). The rejection of record was maintained. Such rejection is summarized below.

Dodge is cited as providing "the instant polyurethane systems (col. 6 lines 30-37, 49-55) able to provide protective coatings permitting slow release of pesticides, or microcapsular...." Balm Paints is cited a providing "pellets of pesticides (p. 3, lines 99-105) of polyethylene polyurethane polymers (p. 3, lines 16-35) for inclusion in film-forming coating polymers (P. 4 lines 77-95)." Finally, Van Voris is cited as teaching barriers for wood structures "incorporating insecticides (col. 5, top) as a slow release transport polymer system." Polymers are stated to be included at col. 5, ll. 66-67 and pellets at col. 9. The cited art combination, then, structured by the Examiner is that the skilled artisan desiring to utilize pesticides for timed delivery would use polyurethane coatings or pellets of Dodge incorporating insecticides/pesticides of Balm Paints, and specifically those shown in Van Voris.

Applicants respectfully traverse the art rejection of the claims and grounds therefor.

§ 112 Rejection

The Examiner states, *inter alia*, that, "Applicant argues the polymer is enriched, but does not say to what extent—one moeity so qualifies..." (Office action of 7/5/2005, p. 2). Conventional polyurethanes are too sensitive to moisture, light, heat, and a variety of environmental factors. Of importance in the present invention is the recognition that the transport polyurethane polymer (transport in the sense that the active pest control ingredient is transported from the interior of the pellets to the outside via the polyurethane) must be synthesized to retard the transport of the pest control agent. The application, then, gives numerous techniques for accomplishing this goal. Both the isocyanate and the polyol component of the transport polyurethane can be modified.

As a practical matter, conventional polyurethane polymers contain less than about 0.1% urea groups. To be enriched, then, means that the transport polyurethane polymer of claim 34 contains more than 0.1% urea groups. However, Applicants' disclosure teaches increasing the hydrophobicity of the transport polyurethane. Techniques for accomplishing this include, *inter alia*, replacing aromatic isocyanates with aliphatic or alicyclic isocyanates, *to wit*:

> Aromatic isocyanates are replaced with aliphatic or alicyclic isocyanates, and polyols that contain ester or ether linkages are replaced with aliphatic or alicyclic diols. These changes make the product much more durable.
>
> Application @ p. 11, ll. 7-9.

Next, Applicants' disclosure teaches replacing most of the polyol with an amino compound, *to wit*"

> The sprayability and longevity needed for some applications of this invention cannot be attained with conventional polyurethane technology in which isocyanates are reacted only with polyols. The polymerization time is too long and the degree of crosslinking is not sufficiently high. In this invention, most or all of the polyol is replaced with amine-containing ingredients. In such cases the transport polymer will predominate in urea groups, rather than urethane groups.
>
> Application @ p. 12, ll. 8-13.

Polyols that can be used in another embodiment should be short-chain and have a molecular weight of less than around 1,000, *to wit*:

> Soft segments contribute to water absorption that reduces longevity. A soft segment in polyurethanes is defined as a portion of the polyurethane molecule that is amorphous or low in crystallinity. Such regions usually arise from the polyol component. They can be caused by use of long-chain polyol ingredients or by using shorter chains but having frequent amorphous regions. In this invention, the formulator uses short-chain polyol ingredients (*e.g.*, polypropylene glycols with MW < 1000, preferably about 300 daltons). The formulator also limits the polyol content to less than about 20%.
>
> Application @ p. 14, ll. 6-12.

So-called "hard segments" are another embodiment and this relates to polymer crystallinity and crosslink density, *to wit*.

> The hard segments of the polymer chain are crystalline or crosslinked. They resist permeation by water and oxygen. This barrier attribute contributes to the

longevity of the product. The barrier attribute applies also to the active ingredient so that the release rate is reduced by the presence of hard segments.

Application @ p. 14, ll. 20-23.

Thus in this invention, alicyclic/aliphatic isocyanates are employed in ways that generate polyurethanes with a high percentage of hard segments.

Application @ p. 17, ll. 8-9.

Six different types of crosslinking are disclosed that increase the polyurethane's crosslink density, *to wit*:

1. Use of isocyanates with functionality greater than 2 creates crosslinks between polymer chains. A commercially available example is polymeric methylene diisocyanate (PMDI), which has an average number of isocyanate groups that is between 2 and 3. Another commercially available isocyanate with functionality greater than 2 is the product obtained by reaction of HDI with water. It has a functionality of 3.
2. Use of low molecular weight polyols with functionality greater than 2 creates tight crosslinks between polymer chains. These crosslinks are involved in generating hard segments in the polyurethane. Examples of hydroxy crosslinkers include trimethylolpropane, glycerin, and sorbitol.
3. Use of polyols with functionality greater than 2 also creates crosslinks between polymer chains. The tightness of polyol crosslinking is less than that achieved with isocyanates or low molecular weigh polyols because the polyol chains are much longer. Examples of polyols with a functionality of 3 include glycerin polyether triols, and trimethylol propane polyether triols. Hydrogenated castor oil, which has a functionality between 2 and 3, is a polyester that has crosslinking capabilities.
4. In a system in which the molar equivalents of the diol are reacting with the isocyanate, there is still an opportunity for crosslinking by allophanate formation. The hydrogen of the –NH group of a urethane can react with an isocyanate group associated with another chain which forms a branching at this point. This means that a hydroxyl group somewhere in the polymer does not have an isocyanate partner. Thus, the polymer becomes crosslinked, but it also has developed some weak points where hydroxyls are not reacted. However, the formulation can be modified to have an excess of isocyanate groups above that required by stoichiometry in order to accommodate such unreacted hydroxyl groups. Then, allophanate crosslinking can be used without leaving unsatisfied hydroxyls. Use of vaporous amine catalysts would be desirable to obtain the most complete reaction of the residual hydroxyls (for example, U.S. Patent No. 4,517,222).
5. Reaction of isocyanate with water yields free amine groups, which are much more reactive with isocyanate groups, so that di-substituted urea groups are formed. These ureas also can react with isocyanate groups to form highly stable biuret groups. Thus, astute use of moisture can cross-link the polyurethane to make it more resistant in the environment. Instead of using the reaction of water with isocyanate to make the amine,

it may be more desirable to manufacture the polyurea more directly as described above wherein isocyanate compounds are reacted with amine compounds, which then is added to the isocyanate cross-linkers to form polyureas. Then, the crosslinking amine need not be the one that results from reaction of the isocyanate with water.

6. Virtual Crosslinking via Hydrogen Bonding is associated with the development of hard segments. This concept allows a product to have a higher percentage of hard segments than would be possible in conventional polyurethane systems. Hydrogen bonding "virtual" crosslinks are reversible and, therefore, of value to this embodiment of the invention. The major hydrogen bonds are those between –NH and –C=O groups located in separate chains of the polymer.

Application @ p. 15, l. 1 bridging p. 16, l. 16.

The polyol component in the embodiment that uses polyols to form the transport polyurethane polymer are disclosed as follows:

The aliphatic or alicyclic polyol component of the polyurethane of this invention includes the diol described above and other diols as follows:

1. straight chain hydrocarbons that have 8 to 30 carbons with hydroxyl groups at each end;
2. carbocyclic rings that contain from 5 to 32 members with hydroxyl groups that are not on adjacent carbons; and
3. molecules that have one or more rings, as defined in item 2 immediately above, that have two straight chain hydrocarbon chains that are substituents, with two hydroxyl groups are present, one at the end of each pendent chain.

Application @ p. 16, l. 31 bridging p. 17, l. 7.

Thus, Applicants' disclosure specifically discloses numerous techniques (embodiments) for improving the hydrophobic content of the transport polyurethane in order to slow down the migration or transport of the pest control agent from within the transport polyurethane to the environment for the pest control agent to display is desired pest control abilities.

Now, independent claim 34 claims 3 different techniques for "enriching" the transport polyurethane in containing hydrophobic segments, *to wit*, (1) use of non-aromatic (*i.e.*, aliphatic and alicyclic isocyanates), (2) being enriched in urea linkages (≥ 50% urea linkages, as disclosed at p. 12 under Embodiment #1), and (3) by containing hard segments (as defined by the passages cited above).

Applicants submit that they have taught the skilled artisan that the transport polyurethane should be formulated to retard the ability of the pest control agent to be released

from the transport polyurethane and several specific techniques therefor. As such, Applicants have complied with the provisions of § 112 of the Patent Statute.

Combination Rejection

The Examiner faults the claims as not claiming "any specific duration, pesticide and pellet polymer". With this statement Applicants take strong exception.

As an initial matter however, claim 34 calls for a polymer pellet, *to wit*:

> a transport polyurethane polymer enriched in hydrophobic elements comprising one or more of non-aromatic isocyanate segments, being enriched in urea linkages, or containing hard segments

It seems clear to Applicants that a specific polymer composition is claimed. Second, not just any polyurethane is claimed, but a polyurethane "enriched in hydrophobic elements comprising one or more of non-aromatic isocyanate segments, being enriched in urea linkages, or containing hard segments". The Examiner has pointed to no line of disclosure in any cited reference teaching "a transport polyurethane polymer enriched in hydrophobic elements comprising one or more of non-aromatic isocyanate segments, being enriched in urea linkages, or containing hard segments".

Next, the Examiner has not cited any patent that teaches dispersing a pesticide pellet in Applicants' "transport polyurethane polymer enriched in hydrophobic elements comprising one or more of non-aromatic isocyanate segments, being enriched in urea linkages, or containing hard segments". As pointed out in the application and prior responses by Applicants, the key to "sustained release" of a pesticide is to slow down its release. The transport polyurethane polymer is designed to do just that—slow down release of the pesticide, regardless of the precise composition of the pesticide or the pellet in which it is absorbed. The art fails teach slowing down the pesticide release in general and certainly not how Applicants achieve such slowing down. As such, the combination of art cited fails to render obvious claim 34.

Greater detail on the transport polyurethane polymer is given in claims 43-55, 59-62. Again, the art fails to teach these compositions, as claimed.

As to specific polymer pellet compositions, dependent claims go into much greater detail as to the precise types of polymer pellets and pesticides used. For example, claim 35 shows a polymer pellet, which is "one or more of polyethylene, polypropylene, polybutenes, natural rubber, polyisoprene, polyesters, styrene butadiene rubber, polyacrylates, polymethacrylates, polyethylene terephthalate, epoxy resins, unsaturated polyester resins, or polyurethane

elastomer." Claims 36 and 37 show inorganic sorbents dispersed in the pellets. Claims 38-39 show a barrier material coated onto the pellets. Claim 40 shows a size range of the pellets. It seems apparent to Applicants that the claims do in fact show specific polymer pellet compositions.

As for specific pesticides, while novelty does not rely on specific compositions, claims 57 shows pesticide compositions.

As to durations of the inventive composition, numbers are unimportant. Applicants teach the desirability of several years for their compositions. Applicants then teach how to retard or slow down the release rate of the pesticide. To do this, Applicants teach and claim specific polymer systems that transport the pesticide from within the composition to the outside world where they "do their thing." That transport composition, in claim language, is "a transport polyurethane polymer". Applicants do more by then claiming specific polyurethanes that retard the release of pesticides (any pesticide), *viz.*, polyurethanes "enriched in hydrophobic elements comprising one or more of non-aromatic isocyanate segments, being enriched in urea linkages, or containing hard segments". The art, singly and in combination, fails to recognize the importance in retarding the release of pesticide by use of the specific transport polyurethanes Applicants claim.

Thus, contrary to the broad-brush statement of the Examiner, Applicants do in fact claim specific pesticides, pellet polymer compositions, and durations.

Conclusion

In view of the remarks submitted herewith, allowance of the claims and passage to issue of this application respectfully is requested.

Respectfully submitted,

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